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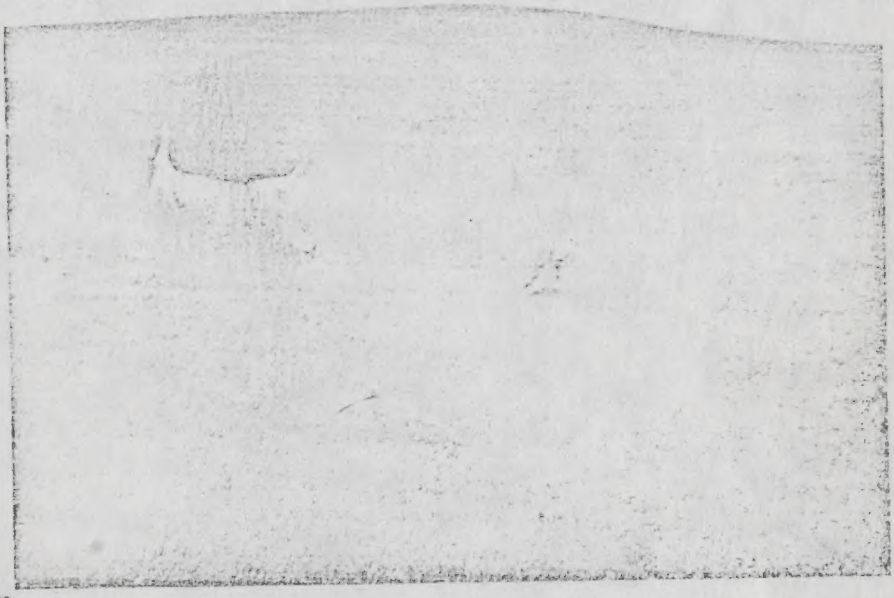
AGRICULTURAL SCIENCES

POISONOUS PLANTS OF THE CANADIAN PRAIRIES

by

J. B. CAMPBELL, R. W. LODGE and A. C. BUDD



CAREFUL PASTURE MANAGEMENT COULD HAVE PREVENTED THESE LOSSES.

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POISONOUS PLANTS OF THE CANADIAN PRAIRIES[1]

J. B. CAMPBELL[2], R. W. LODGE[3], AND A. C. BUDD[4]

Introduction

Poisonous plants are those that contain or produce poisonous substances in sufficient amounts to harm humans and livestock. Depending on the nature of the poison and the amount of plant material eaten, an animal may die, be disabled permanently, or may recover completely. While some plants cause immediate sickness or death following consumption, others have to be eaten for many days before symptoms of poisoning develop. A few plants contain poisons that are excreted nearly as fast as eaten, and losses occur only when large amounts are consumed in a short time or on certain days. Other plants cause wounds or skin eruptions in both humans and livestock. When seeds of at least one plant are eaten, they cause muscle contraction and sleepiness in children.

Although poisonous plants are widely distributed across Western Canada, few are found in heavy stands. Generally, plants with poisonous properties grow amongst others that have excellent forage properties. Further, many have short seasons of growth. Because of the nature of their growth, habitat, and distribution, poisonous plants will be a hazard in the use of native grasslands for many years to come.

Plants With Poisonous Properties

Of some 60 or so plants growing in the Prairie Provinces that are reported to have poisonous characters, only a few are both plentiful and widespread. These include:

Seaside Arrowgrass	—*Triglochin maritima* L.
Death Camas	—*Zygadenus gramineus* Rydb.
Lady's Thumb	—*Polygonum* spp.
Greasewood	—*Sarcobatus vermiculatus* (Hook.) Torr.
Low Larkspur	—*Delphinium bicolor* Nutt.
Tall Larkspur	—*Delphinium scopulorum* Gray
Chokecherry	—*Prunus* spp.
Lupines	—*Lupinus argenteus* Pursh
Milk Vetches	—*Astragalus pectinatus* (Hook.) Dougl. *Astragalus bisulcatus* (Hook.) A. Gray
Timber Milk Vetch	—*Astragalus serotinus* A. Gray
Golden Bean	—*Thermopsis rhombifolia* (Nutt.) Richards
Locoweeds	—*Oxytropis* spp.
Water Hemlock	—*Cicuta Douglasii* (DC.) Coult. & Rose
Baneberry	—*Actaea rubra* (Ait.) Willd.
Poison Ivy	—*Rhus radicans* L.

The above-listed species are credited with causing the greatest losses amongst livestock. At least two may affect adult human beings, and four are dangerous to children.

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Seaside Arrowgrass

Seaside arrowgrass is found in sparse or dense stands on wet saline soils throughout the Prairie Provinces. Occasional plants may grow amongst grasses in marshy areas, but the species is more commonly found in dense stands on wet saline flats. One of the most extensive stands known dominates the vegetation on the neck of land joining lakes Chaplin and Johnstone in southern Saskatchewan.

The plant looks like grass but it can be distinguished by its spongy leaves which are round on one side and flat on the other. During mid-June the flower stalks grow to a height of one to three feet, with many small green flowers on the upper half of the stalk; these flowers in turn produce small oblong pods containing three or six seeds. The leaves have a salty taste and are palatable to all classes of livestock.

Hydrocyanic acid (HCN) is the poisonous principle in arrowgrass. It affects animals quickly. However, death seldom occurs unless an animal eats a lethal dose at one feeding—about 5 pounds of air-dry material with 0·02 per cent HCN content are required to kill a mature cow. Fresh green leaves have a higher HCN content than mature dry plants, and thus hay containing arrowgrass is often fed without loss.

Arrowgrass poisoning is characterized by abnormal breathing, trembling, and staggering, while convulsions usually precede death. Recommended treatments include corn syrup drenches, and intraperitoneal injections of 2 grams sodium thiosulphate with 1 gram sodium nitrite in a 20 per cent water solution. Very hungry animals should not be pastured on land containing arrowgrass. A recently recommended medicinal remedy is a water solution of sodium thiosulphate known to photographers as "hypo" injected into the jugular vein or administered orally. This treatment has not been tested sufficiently to warrant its indiscriminate use.

Death Camas

Death camas is often miscalled the yellow onion because it grows from a bulb, has deep green pulpy leaves, and small yellow flowers clustered at the end of the one- to two-foot flower stalk. However, it does not have the garlic scent of the native onion. Death camas is common throughout the prairie region. Its heaviest stands occur in draws, on hillsides, and around the edges of grassy sloughs, while occasional plants are found on level upland.

Losses from death camas occur from mid-May to late June, and are more numerous on over-grazed than on well managed pastures. The first symptoms of poisoning are salivation and nausea, followed by staggering and prostration; a coma usually precedes death. Breathing is difficult at all times.

Poisoned animals should be kept quiet and provided with food and water. Death camas tablets, if available, may be administered according to directions. However, the only sure way to prevent losses is to keep livestock, particularly sheep, off ground infested with death camas until early July. After this date few, if any, losses are reported from eating this plant.

Lady's Thumb

Lady's thumb grows in shallow water in non-alkaline sloughs and marshes, usually in mixtures with water grasses and sedges. Its vigorous growth, broad green leaves, and clusters of small white, pink, or red flowers distinguish it from the associated plants.

Lady's thumb has a high protein content and is reported to be palatable when fed in hay mixtures. However, when eaten in its green stage it is charged with causing a condition known as photosensitization or yellows, or bighead in sheep, as well as amongst other animals with an unpigmented skin. Losses of weight and condition result from poisoning. Recovery is speeded by keeping animals out of direct sunlight and changing feed.

Greasewood

Greasewood is a spinescent shrub which grows to a height of three feet on many saline flats throughout the prairie area. It grows in association with bluejoint, *Agropyron Smithii* Rydb., and other grasses, and may be either quite sparse or very abundant.

The buds and young leaves of greasewood contain salts of oxalic acid which are the poisonous principles. Poisoning is indicated by depression, and weak pulse and respiration. Losses can be prevented by pasture management practices that defer grazing greasewood-infested areas until after the associated grasses have made a good spring growth. Sheep, and particularly lambs, are reported to be more susceptible to greasewood poisoning than cattle.

Low and Tall Larkspur

Low larkspur grows in the Foothills, Cypress Hills, Wood Mountain, and other high grassland areas throughout the southern prairie region. It seldom attains a height of more than two feet, yet its showy, dark blue, spurred flowers are a prominent feature of its habitat. Plants mature and wither away by mid-July, after making a rapid growth during late May and June. It grows amongst grasses and shrubs and apparently requires some protection to persist.

Tall larkspur is common throughout the Foothills of the Rocky Mountains, and is found occasionally in the northern forests of Alberta and Saskatchewan. Its heaviest infestations are found in open stands of poplar. It may grow to a height of eight feet, although usually shorter, and produces a profusion of blue or mauve spurred flowers on its spike. The leaves are deeply dissected. It commences growth during May and remains green until freeze-up.

Because of its short growing season, the low larkspur causes losses only during the spring and early summer, and thus pastures infested with this plant may be grazed after early July without danger. On the other hand, tall larkspur lives throughout the summer, and thus may be the cause of losses at any time during the grazing season. The presence of these species is not associated with types of pasture management, as both occur naturally in their habitats. Likewise, their seasonal abundance appears to depend on climatic factors rather than on management practices.

Because tall larkspur grows every year it is a potential cause of losses every summer. Low larkspur, on the other hand, occurs in abundance at frequent or infrequent intervals, and thus it is not the year-after-year menace of the tall-growing species.

Sheep are rarely poisoned by larkspur, but cattle are very susceptible. First symptoms of poisoning are loss of appetite, staggering, uneasiness, and constipation. Nausea and bloating may follow, while in severe cases animals fall with their heads pointing downhill and with their legs extended (see cover). Turning an animal so that its head points uphill often helps recovery from mild attacks, while paunching should be done in all cases that are accompanied by excessive bloating.

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Chokecherry

Ranchers report that both cattle and sheep die occasionally after feeding on chokecherry plants. When losses are reported, it is usually found that the chokecherry is dominant over the pasture, either because of natural conditions or as a result of over-grazing. Because losses are reported usually long after they occur, it has been difficult to determine experimentally the conditions that caused the deaths charged to chokecherry. In any case, losses are sporadic, while deaths of lambs are reported more frequently than those of other classes of livestock.

Hydrocyanic acid (HCN) is the factor causing death, the same as in arrow-grass. Symptoms include uneasiness, staggering, convulsions, with bloating preceding death. Corn syrup or glucose drenches are recommended as antidotes. One rancher reported his lamb losses stopped immediately after adding sulphur to his salt supply; a mixture of one part sulphur to twelve parts of salt was used.

Lupines

Lupines are rarely found in the Prairie Provinces except in the Foothills and Cypress Hills where they grow profusely amongst the grass cover. They may attain a height of three feet, bear leaves divided into five to nine leaflets, and have mauve, blue, or purple flowers clustered near the top of the stalk. Cultivation may not kill the persistent roots.

Despite the fact that reports from the Intermountain States charge losses amongst sheep to the lupine common in Western Canada few, if any, losses from poisoning can be blamed on this species on the Canadian Prairies. In fact it is considered to be a good forage plant and is particularly valued in upland hay mixtures. These differences illustrate an important point, namely, that plants may be grazed or fed without loss in one district, while in another region the same species may be the cause of regular livestock deaths.

The poisonous property of lupines is more concentrated in the seeds and pods than in other parts of the plant. Over-feeding on seeds is reported to result in nervousness, labored breathing, convulsions, and frothing. Fortunately, the toxic principle is excreted readily by the kidneys and death results only when the lethal limit is eaten at one feeding.

Milk Vetches

All milk vetches were considered to be fair quality forage plants until a few years ago. Today it is known that at least two prairie species may be poisonous—the two-grooved milk vetch, *Astragalus bisulcatus*, and the narrow-leaved milk vetch, *A. pectinatus*. Both species may contain considerable quantities of selenium, an element that has been charged with causing skin eruptions, contraction of small blood vessels, losses of tail and feet, and sterility in cattle. These species are a natural constituent of the native grass cover wherever the soil overlies marine shales of the Bearpaw, Belly River, Lea Park, and other geological formations laid down during the Cretaceous period. Thus, where abundant, they indicate that the soil in which they are growing may have a high selenium content.

Both species are members of the pea family and both are easily recognized. The two-grooved milk vetch is upright and grows to a height of two or more feet. It has numerous leaflets on its many leaves, and the purple or blue flowers are clustered near the end of the stalk. The narrow-leaved milk vetch is a straggling plant. It has a few long, narrow leaflets on each leaf, and a few cream-colored flowers at the end of the nearly prostrate stalk. The former grows on shale outcrops, around sloughs, and in badlands, the latter amongst the grass on sandy-loam and loam soils.

Although both plants are unpalatable, their presence indicates that grasses and other plants growing adjacent may contain variable amounts of selenium. Analyses of Western wheat grass plants growing a few inches from the narrow-leaved milk vetch showed that the grass contained selenium concentrations of 35 parts per million, whereas none was found in the same species five feet away. Concentrations of five parts per million, or over, are recognized as potentially dangerous.

No cases of selenium poisoning have been reported during recent years in Western Canada. However, losses charged to this element occurred during the drought years of 1936-37, when cattle were fed large amounts of poor quality hay harvested from seleniferous soils. If, because of drought, over-grazing, or other causes, livestock are ever again forced to eat hay with a high selenium content there is a possibility of the recurrence of losses. With careful pasture management and sufficient reserves of good quality winter feed, no losses from selenium poisoning should occur.

Locoweeds

Locoweeds are members of the pea family. They are short, seldom over a foot in height, with each leaf and flower stalk growing from the crown. The yellow or blue flowers mature into pods containing loose seeds which rattle when shaken. Locoweeds occur throughout the prairie region and extend into the surrounding bush and forest.

Nine species of locoweeds have been collected in the Prairie Provinces, but dense or extensive stands are rare. When these plants are consumed by livestock a disease known as locoism may result. This is recognized by dullness, irregularities in gait and in eating habits, rough coats, and loss of muscular control in horses. Cattle and sheep are less readily poisoned and their symptoms, though similar, are not so pronounced.

Locoism occurs rarely, if ever, today. Yet it must have been fairly common amongst livestock in the early days of settlement if diagnoses were correct. The best recommended cure is the same today as it was 75 years ago, namely, move poisoned animals from infested areas and provide palatable and nutritious feed until they recover. A suggested medicinal treatment for cattle consists of hypodermic doses of 4/20 of a grain of strychnine inserted in the shoulder daily for a 30-day period. Fowler's solution in water is suggested for horses—$\frac{3}{4}$-ounce daily.

Timber Milk Vetch

Timber milk vetch is a common poisonous plant of the upper grassland and lower montane forest pastures in British Columbia. It has been collected also east of the Rocky Mountains near Canmore and Cochrane in Alberta, and at Fort St. John in the Peace River block of British Columbia. It is a tufted member of the pea family with greyish leaflets and white, pink, mauve, or blue flowers.

Timber milk vetch poisoning is more common in lactating cows, ewes, and mares than in other classes of livestock, though apparently no class is immune. Symptoms are variable but emaciation, faulty digestion, hypersensitivity and partial paralysis of the hindquarters are the most common. As the poisonous principle is not known, the only recommended remedy is to move affected animals to range free of the poisonous plant.

Golden Bean

The golden bean, also known as the golden pea or buffalo bean, is another member of the pea family that has poisonous properties. It is an early season plant with a wide distribution. It grows about one foot in height, has three leaflets, showy yellow flowers, and its pod forms a half circle when ripe.

Although the entire plant is eaten by livestock with no known ill effects Dr. J. A. Matheson, Gull Lake, reported that four children were poisoned after eating its ripening seeds. A narrative in the September, 1952, issue of the *Canadian Cattlemen* reports a similar case in 1880 when children of a Mr. and Mrs. Morden were "badly sickened" after eating seeds of the golden bean. In the cases reported the symptoms of poisoning were dopiness, prostration and convulsions. Sedatives and rest were recommended and the children recovered. Although the condition of poisoning has not been reproduced experimentally, nevertheless these reports should be heeded and young children warned against eating the seeds of this plant.

Water Hemlock

Water hemlock has been collected from springs and marshes across Western Canada. Because it usually grows on ground inaccessible to grazing livestock there are few records of losses that can be charged to it. Experimental feeding of its roots to rabbits failed to show that the species growing in Saskatchewan had lethal properties, but losses of sheep in the Lac Pelletier area were attributed to this plant. Thus, its eradication is recommended if the site is accessible.

The water hemlock is often confused with the palatable and apparently non-poisonous water parsnip which grows in sloughs as well as in springs and marshes. However, they can be distinguished easily, because the tri-pinnate compound leaves and the cross partitions in the hollow stem base are characteristic of the water hemlock not possessed by the water parsnip (refer to illustration to distinguish these plants). Fruit and leaves of the water hemlock have been grazed or fed in mixed hay without loss, as these portions of the plant contain relatively small amounts of the toxic compound compared with the high concentration found in the roots.

Animals poisoned by water hemlock froth at the mouth and display signs of uneasiness and pain. This is followed by violent intermittent convulsions during which the animal kicks, extends its legs rigidly, throws back its head, and bellows and groans loudly. The convulsions grow more violent until terminated by death. All cases are not necessarily fatal but there is little, if anything, that can be done to aid recovery.

Baneberry

The baneberry is often found in shaded ravines and woodlands. It has large, compound leaves, and a compound raceme of white flowers; its berries are red and grow in clusters. The berries are very attractive to children and several cases of poisoning as well as deaths have been attributed to eating fruit of this plant.

Poison Ivy

This common but seldom recognized plant grows in open woodlands and in other partially protected sites. It is distinguished by its compound leaves composed of three leaflets, woody stem, and greenish-white berries. The poisonous properties are contained in the stem, leaves, flowers, and fruit. Contact with the plant causes skin blisters and inflammation. After contact the affected parts should be thoroughly washed with a lather of warm water and laundry soap. The rash can be treated with Condy's Fluid, a solution made by dissolving a five-grain tablet of potassium permanganate in a quart of water. It is advisable to consult a doctor in all cases.

Other Poisonous or Harmful Plants

The previous sections have described the characteristics of the more important poisonous plants growing throughout the prairie area of Canada. However, there are several other plants that when eaten or touched might cause sickness, or even death, in humans and animals.

Several members of the nightshade family contain glucosides that may or may not be poisonous. As a general rule, fruits of the common potato, bittersweet, henbane, jimson-weed, black nightshade, and wild tomato should never be eaten as all contain toxic substances that may cause mild to severe cases of poisoning. Likewise, the foliage of the plants contains the same poisonous substances although usually in smaller amounts than found in the fruit. The tubers of the common potato, after exposure to sunlight which causes them to turn green, may be poisonous and should not be eaten by humans or fed to livestock.

All dogbanes and milkweeds contain an acid, milky juice that may affect certain individuals. Thus, these plants should be handled carefully lest the sap enter a scratch or be rubbed into the eyes. At least one milkweed, rarely found in Western Canada, causes cattle deaths when eaten in sufficient quantities, while the common milkweed may induce convulsions in cattle and sheep if large amounts are consumed.

Leafy spurge, *Euphorbia Esula* L., which is becoming established as a weed on cultivated land throughout Western Canada, contains an acid, milky juice that causes blistering and inflammation after contact. These conditions may affect both humans and livestock. Reports suggest that losses of cattle may occur when hay containing large quantities of leafy spurge is fed.

The common scouring rushes, *Equisetum* spp, also known as horsetail, are reported to cause livestock losses when fed in hay; horses apparently are more susceptible than sheep or cattle. No known ill effects are caused by these plants when they are pastured. In fact, stockmen report that sheep will seek areas where horsetail is abundant and thrive on the feed.

Sneezeweed, *Helenium autumnale* L., is abundant around sloughs and along watercourses and roadsides throughout Western Canada. Because it is unpalatable and because it grows only where grasses and other forages are producing heavily few, if any, reports are available of livestock losses caused by this plant. However, it has poisonous properties and, if livestock are forced by circumstances to eat it, loss of condition and death may occur.

Blue-green algaes, *Cyanophyceae*, form the so-called "scum" in sloughs, lakes, streams, and water troughs. These cause disagreeable odors in the water and reports state that livestock losses may occur when animals drink water containing large amounts. Reports from the North Central States have stated that sheep and cattle died after drinking at spots where wind had collected large quantities of algae. Apparently natural populations of algae are not sufficient to create toxic conditions, but wind action may cause the algae to accumulate at a natural watering site. The poisonous factor has been charged to both the entire plant and by-products of decomposition, particularly nitrates.

Western yellow pine, *Pinus ponderosa*, Dougl., is a recent addition to the list of plants with poisonous properties. Reports from British Columbia state that its fresh needles and buds cause abortion in cows and the birth of weak calves. It is recommended that bred cows be wintered in areas free of western yellow pine.

Humans and animals vary greatly in their susceptibility to other plants that may cause skin blisters, swellings, hay fever, and other annoying conditions. Species of nettles, hops, smartweeds, ragweeds, and false ragweeds have properties that may be classified as mildly to moderately poisonous. Although few people and fewer animals will be affected severely by the toxic properties of these plants, nevertheless it is wise for all to handle them carefully.

Losses Caused by Common Cultivated Plants

Occasionally livestock losses are charged to eating cultivated forag Sorghum, flax, and oats on occasion may contain poisonous compounds. T conditions producing their toxic qualities are discussed briefly.

Sorghum

During the past few years, sorghums have been tested and grown to limited extent on farms throughout southwestern Saskatchewan. The f sorghum crop on one of these farms caused the deaths of three registered Sho horn cattle. The crop in question had been cut for hay and its aftermath v pastured.

When sorghums are frozen or stunted by drought, they produce vary amounts of hydrocyanic acid (HCN), the same toxic principle that is produ by arrowgrass and chokecherry. Losses may occur if the crop is pastu immediately after a frost. In few cases will sorghum hay cause losses beca the acid disappears quickly as hay matures. However, on the basis of th results, sorghum should not be pastured for seven to ten days following heavy frost.

Flax

Common flax can cause livestock poisoning. The poison produced is hyd cyanic acid, the same as that occurring in sorghum, arrowgrass, and cho cherry, and the same precautions should be followed as recommended sorghum. In general, the highest concentration of hydrocyanic acid is fou in frozen, immature bolls.

Nitrate or Oat Hay Poisoning

Occasionally animals are poisoned when fed oat hay which has a h nitrate content. High nitrate content occurs also in a few weeds, and qu often in well water. However, poisoning caused by the high nitrate cont in oat hay has become so common that the condition has been called "oat h poisoning." None of the other cereal hays has been charged with causing t condition, nor have green oats used as pasture.

The first record of the condition was reported in Indiana in 1898, wh cattle were fed corn stover grown in a hog yard. The peculiar conditions the sickness were reported over many of the Western States and Canada dur subsequent years, but not until the mid-thirties was it shown that the sickn was caused by high nitrate content of feed. It was established that the nitra after being changed to nitrite in the rumen of cattle and sheep, entered blood where it prevented the haemoglobin of the blood from carrying oxy and thus animals died of suffocation. Concentrations of 1·5 per cent potassi nitrate or saltpeter in cured feed are sufficient to cause death.

Livestock react in various ways. Some become listless and will stand a time before lying down; others will push against their stalls or feeding ra and show evidence of hypersensitivity. Nearly all will gnaw wood. At tir their pulse and respiration are normal, at other times extremely rapid, but death approaches both become slow and faint. The blood of poisoned anim is a very dark brown.

Although feeds can be analyzed to determine their concentrations of nitra there is no assurance that a feed containing nitrate will cause death at a particular time. It appears that the condition of the animal itself will of determine its susceptibility, and hay with a high concentration of nitrate mi be fed safely one day, while next week it could be toxic or lethal.

Intravenous injections of a four per cent solution of methylene blue in water are recommended as an antidote, and approximately one ounce of the solution per 300 pounds of live weight is suggested. A recent report from South Africa shows that large amounts of saltpeter can be fed, or hay with relatively high nitrate content can be used, provided molasses or another supplement with a high sugar content is added to the ration.

Recently cattle deaths were charged to the high nitrate content of the well water they were drinking. The Saskatchewan Department of Health has demonstrated also that water from nitrate-polluted wells can cause deaths of infants when the water is used in baby formulae. In view of these results, it appears advisable to check old wells, particularly shallow wells adjacent to barnyards, for their content of nitrate.

Bloat

Bloat, hoove, or hoven is a spectacular disease of cattle, sheep, and goats. Its symptoms are shown by rapid swelling of paunch or rumen caused by above average gas pressure; death often succeeds the stomach distention unless the pressure is relieved. Despite its common occurrence for over 200 years, very little more is known about its causes and remedies than when it was first reported.

Bloat is more common on pasture than on dry feed, and more common on pastures containing a large proportion of alfalfa or clover than on those producing grasses only. Furthermore, it is more common on irrigated than on dryland pasture. Although alfalfa and clovers may cause bloat more generally than other crops, well-cured hay, grain, roots, grass, kale, and milk will cause bloat under certain conditions.

Authorities agree generally that bloating is caused by an upset in the mechanism to expel gas from the paunch, not by the quantity of gas produced. Expulsion of gas by eructation or belching may be stopped by physical obstructions in the esophagus or gullet, by the frothy mass in the paunch that occurs with certain types of bloat, by ruminal paralysis, or by a large mass of free gas collected in the paunch. The escape of gas from the paunch to the gullet is made difficult by the anatomy of ruminants because the gullet enters the paunch near its bottom and is usually below the top level of the mass of digesting feed that it contains.

Many odd remedies have been recommended to cure the disorder, including a pint of gin, tar in eggshells, and formaldehyde in ale. The common remedy recommended today is a drench of two to four ounces of turpentine, ginger, and capsicum in a half pint of milk or water. Formaldehyde and coal oil have been used also, but both are more toxic than turpentine and should not be used if the other is available. All severe cases should be paunched with a trocar or a sharp knife, but relief will not be effected by this method unless the main air bubble is tapped. In those cases where the paunch is filled with a mass of frothy bubbles, the trocar by itself may be of little benefit. Under such conditions the trocar opening can be enlarged to four or six inches with a sharp, clean knife and the frothy mass scooped out. An injection of adrenalin is recommended in those cases where bloating is not too severe. A veterinarian should be consulted in all cases of bloat.

Prevention of bloat is probably impossible, although strongly growing grasses in a grass-legume pasture help greatly to prevent the disorder. Reports and observations indicate that bloat will seldom occur when the grasses are taller than the legumes and when they provide at least 50 per cent of the forage. A feed of well-cured hay is suggested also before placing livestock

on lush pasture, although this is not a sure remedy. It is recommended also that livestock be kept off pastures until the morning dew has disappeared, but again animals have been known to bloat on dry pasture or feed.

A Potential Invader With Poisonous Characters

As information regarding the natural plant cover increases, it can be expected that other plants will be added to the present list of those with poisonous characters. The greatest concern will be with those that may invade or be introduced, although native plants are not immune from suspicion.

There is a poison-containing weed growing in the Intermountain States that might invade the rangelands of Canada. It is known as halogeton. *Halogeton glomeratus* C. A. Mayer, it is poisonous to sheep and causes loss amongst cattle. It is a native of Central Asia and was first reported in Nevada in 1934. Today it is widespread through Nevada, Utah, Wyoming, Idaho, Colorado, California, and Montana, and infests an estimated 1,500,000 acres of rangeland.

Halogeton is an annual resembling Russian thistle in size, appearance and growth habits. However, its leaves are shorter and rounder than those of Russian thistle, and its seeds are not enclosed with spiny scales. Mature halogeton plants are usually straw-colored, rather than dark brown like the Russian thistle. It has been shown that the plant contains large quantities of salts of oxalic acid, the same poisonous principle occurring in greasewood, although there is no agreement that these compounds are the cause of death.

Recommended control consists of good range management where pastures are in a healthy condition, and reseeding with suitable grasses where pastures are depleted. Halogeton thrives on ground bare of perennial vegetation and maintains or increases its stand on over-grazed range. It has been controlled by applications of 2,4-D. There is no known medicinal remedy for poisoned animals.

Because halogeton has already moved north from Nevada to Montana, it is reasonable to presume that its northward extension will continue. Thus stockmen living near the International Boundary are advised to watch their ranges for its appearance. The presence of any unusual plant should be reported to District Agriculturists, Universities, or Experimental Stations.

Pasture Management in Relation to Poisonous Plants

There are several poisonous plants with a wide distribution, yet, with the exception of deaths caused by death camas and the larkspurs, there are few regular losses, or at least few reported losses. Whenever and wherever spectacular losses caused by poisons occur amongst livestock, the cause is usually associated with conditions that are abnormal. A few of these are discussed below.

Over-grazing

Over-grazing causes the most desirable and valued forage species to diminish in population and in size of indiviual plants. As this practice is continued, less palatable plants increase in abundance. Amongst those that increase as the grasses decrease are death camas, milk vetches, crocus anemone, several sages, annuals of the mustard family, cacti, and many others. These include poisonous species which, because of greater population, will be eaten to some extent. Losses amongst sheep on a ranch in southern Alberta were

traced to an increased population of death camas on over-grazed spring pasture. Thus the maintenance of pasturage in a productive condition is one of the principles to observe in the control of poisonous plants and the reduction of livestock losses.

Date of Range Readiness

All pastures have a date on which they are ready for grazing in the spring. Grazing too early, before the forage species have made much growth, is one of the factors causing an over-grazed condition. It is seldom that native pastures are protected until they are ready for use, and thus the earliest growing species carry the grazing load. Amongst the earliest to show green leaves are death camas, chokecherry, and greasewood in the plant associations where they are constituents. Losses sustained by the Eastend Sheep Co-operative, Eastend, Sask., were traced to too early pasturing over ground infested with death camas. The same condition caused poisoning in a herd of range bulls—4 out of 65 died before the operator moved them. Losses up to 10 lambs per day were charged to chokecherry eaten on over-grazed spring pasture in the Great Sandhills, but when the flock was moved to chokecherry-free pasture the losses ceased.

Movement of Hungry Livestock

Movement of livestock at any season of the year, and particularly during the spring and early summer, offers an opportunity for animals to graze poisonous plants. One of the few recorded losses caused by arrowgrasses in Western Canada was traced to the trailing of a band of sheep from one pasture to another. The flock stopped for half an hour at the margin of a dry slough infested with arrowgrass. Twenty-five lambs out of a flock of 600 ewes and lambs died very quickly. When animals are being moved their grazing habits are disturbed; they are hungry and are apt to eat large amounts of easily available forage, and thus graze plants that they refuse in their home pastures.

Drought

Greater losses from poisonous plants may occur during drought. The general lack of feed forces stock to eat any plant available. Losses chargeable to selenium poisoning occurred following the drought during the mid-thirties. On one ranch, where 30 cows died and over 100 were sick during the winter of 1937-38, the deaths were traced to a high selenium content in the winter roughage. The feed was gathered from a cultivated field that had a heavy stand of selenium-indicator plants and where the rye and Russian thistle crop contained toxic amounts of selenium. In any seleniferous area, when drought or other cause makes it necessary to feed poorer quality hay, it is advisable for livestock producers to check closely on their winter feed supply and be certain that the feed does not contain poisonous properties.

Irregular Occurrences

No particular reasons can be ascribed for the abundance of other poisonous plants during certain years. Such is the case with the low larkspur. In any year it may be abundant and losses can be traced to its prevalence, while during succeeding years it may be relatively sparse and livestock losses are rare. Good pasture management practices, removal of stock from infested areas to those where lighter concentrations exist, and riding amongst the herds to give attention to affected animals during the short larkspur season are methods that are followed by stockmen to reduce losses.

Irregular occurrences of losses from poisonous plants are often caused livestock operators themselves. Over-grazing, lack of care during movi too early seasonal grazing, insufficient riding, as well as poor salting and fenc practices, may be factors that add to livestock deaths. When the effects drought are added, new and more startling poison plant losses may occur ev under the best management practices. In such cases the assurance that f is free from poison principles is valuable; such can be secured by laborat tests to determine the content of some of the known plant poisons. Howe there is always the possibility that new diseases caused by plant poison a deficiencies may develop under conditions of drought or over-grazing.

General Management

These regular or irregular losses caused by poor pasture managem might be extended. However, they account for most of the spectacular los from poison, and are the direct result of mismanagement and carelessness ignorance on the part of the livestock operator. The fact that losses fr poisonous plants are kept relatively low on ranches is a tribute to the care management that most ranchers practise. Where losses on pasture contin year after year, the best courses open to a livestock operator are either move the stock to areas free of poison-containing plants or to provide c tivated pasture during the season of particular need. An over-grazed past is one where desirable forages are in short supply; early grazed pastu likewise have insufficient palatable feed to meet animal needs. One solut of the feed problem under these conditions is to cultivate selected areas native pasture and reseed with suitable pasture species.

Control of Poisonous Plants

Control of poisonous plants by methods other than pasture manageme has not been practised widely. Grubbing is practical to eradicate wa hemlock and tall larkspur, and their control is achieved by this method some ranches and in PFRA community pastures. However, all other spec have such a wide distribution and a varied habitat that grubbing is impracti Where death camas and low larkspur are troublesome, the best and m efficient method of eradication is by cultivation followed by reseeding grasses suitable to the soil and climatic conditions. Although the cultivati of extensive range areas to develop a summer pasture may not be warrant nevertheless cultivation and reseeding of selected areas for spring pasture not only practical but is being done by many farmers and ranchers. Usua this practice is followed in order to increase feed supplies during cert seasons of the year, but it is equally valuable to provide range free of pois plants.

Only a small amount of work has been attempted in Western Cana with herbicides for poison plant control. Because the native sward is a compl mixture of forages and weeds, and because many herbs and shrubs are valua forage plants, heavy feed losses may be sustained by using herbicides. T years after treating death camas sites with Atlacide at the Dominion Ran Experiment Station, Manyberries, Alta., it was found that few grasses h re-established themselves, that the camas were abundant, and that cactus h invaded the plots. Work currently under way with 2,4-D preparations inc cates that applications heavy enough to kill pasture weeds affect the se setting of native grasses and reduce the populations of certain broadleav palatable plants.

Summary

There are a few points that need to be emphasized. These are:

1. Of the 60 or so poisonous plants collected, only 12 to 15 are abundant and have a widespread distribution.
2. Many of the plants that are abundant have a short growing season.
3. Poor pasture management practices, including very early spring grazing, carelessness during moving from one pasture to another, and overgrazing, are responsible in part for losses that occur.
4. Losses may increase during periods of drought because poorer quality feeds are eaten, both as pasture and as roughage.
5. Eradication of many poisonous plants is possible, although no one method is applicable to all species.
6. Good pasture management, based on a knowledge of the growth habits of the different species, is effective in reducing losses.

When poisonous plants kill livestock, it can be expected that other animals in the flock or herd will be affected to some degree. It is possible to count deaths, but it is difficult to measure losses due to chronic conditions. Good pasture management will reduce the number of deaths and maintain livestock in a thrifty condition.

Appendix I

DESCRIPTION OF PLANTS POISONOUS TO LIVESTOCK

Name of Plant	Where it Grows	When it Occurs	Description of Plant
Arrowgrass *Triglochin maritima*	Wet alkaline soils.....	April to October...	Perennial marsh plants, stem up to 2 feet high unbranched from short rootstocks and fibrous roots; leaves long, narrow, spongy, bright green; flowers in a raceme, green in color: fruit twice as long as thick and with 3 or 6 seeds; leaves have salty taste.
Death camas *Zygadenus gramineus*	Moist coulees and plains	April to June.....	Low growing, early herb with bulb-like root 3 to 5 inches below soil surface; leaves grasslike, 4 to 8 inches long; flowers pale yellow in dense spike, 8 to 15 inches high.
Greasewood *Sarcobatus vermiculatus*	Drier alkaline areas....	April and May.. .	Much branched shrubby perennial with spiny branches; grows to a height of 1 to 6 feet; stems almost white; leaves yellowish-green, linear and 1 to 1½ inches long; male flowers in spikes at end of stems, female flowers at base of leaf stalk; seeds surrounded by a broad membranous wing.
Low larkspur *Delphinium bicolor*	Open hillsides and brush, Cypress Hills and Foothills.	June to August.....	Perennial with fleshy fibrous root; hairy stems 6 inches to 2 feet high; leaves hairy, much cleft and dissected and borne on long stalks; flowers dark blue, petals pale brownish-yellow with a long spur at rear of flower, borne on long stalks in a loose raceme.
Tall larkspur *Delphinium scopulorum*	Foothills.....	June to September.	Similar to above, 1 to 6 feet high; stem smooth; leaves only slightly hairy; flowe a darker blue and borne in a long dense raceme.
Chokecherry *Prunus virginiana*	Sandhills and coulees.	May to October...	Small tree or large shrub up to 25 feet tall with smooth, reddish-brown stems; leaves oval, rather thick, 1 to 3 inches long, and smooth on both sides; flowers white, about ⅜ inch across in dense racemes; fruit a tart black cherry, round, about ⅓ inch in diameter.
Silvery lupine. *Lupinus argenteus*	Open grasslands in the Cypress Hills and Foothills.	June to August.....	Shrubby herb, 1 to 2 feet tall; stem branching, covered with silky hairs; leaves have 6 to 8 narrow leaflets ¾ to 2 inches long, sometimes silvery hair above: flowers purple or light violet, occasionally white, and are borne on long terminal racemes; pods silky hairy, about ¾ inch long containing 3 to 6 seeds.
Milk vetches *Astragalus bisulcatus*	Knolls, ridges, plains, and slough edges.	May to September	Stout, many stemmed plant, 1 to 3 feet in height, having a distinctive disagreeable odor; leaves have 17 to 27 elliptical leaflets from ⅜ to 1 inch long; flowers deep purple in long, dense raceme at the ends of long stems; pods are ½ to ¾ inch long with two deep grooves down one side; plant contains selenium.

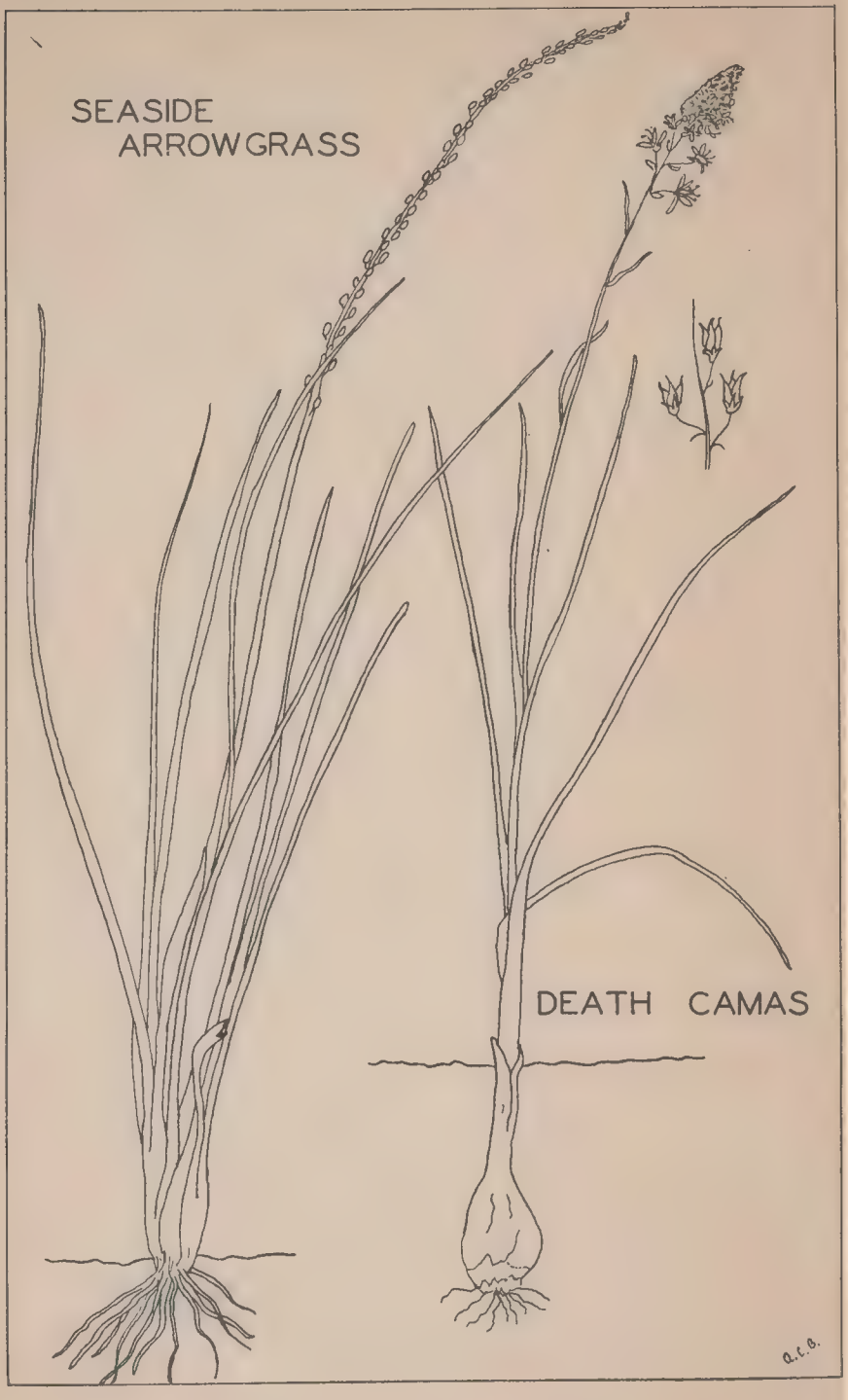
Astragalus pectinatus	Knolls, ridges, plains, and slough edges.	May to August....	Straggly, many stemmed (plant, 1 to 2 feet high, with 11 to 21 very narrow linear leaflets $\frac{1}{2}$ to 3 inches long; flowers cream colored, showy, $\frac{3}{4}$ to 1 inch long, borne in long raceme of 5 to 20 flowers; pods $\frac{1}{2}$ to $\frac{3}{4}$ inch long and circular in cross section; plant contains selenium.
Locoweed *Oxytropis* spp.	Knolls, ridges, and plains.	Entire summer....	Low, perennial herbs, usually with no apparent stem; odd-pinnate leaves and pea-like flowers growing from crown, borne in a spike or raceme; the keel (lower petal) of the flower is extended to a protruding point.
Western water hemlock *Cicuta Douglasii*	Springs and marshes...	Entire summer....	Stout stemmed plant with swollen bulbous rootstocks, which are divided horizontally into chambers; plants grow from 1 to 6 feet in height and are often much branched; leaves twice pinnated with harrow, sharp-toothed leaflets 2 to $3\frac{1}{2}$ inches long; flowers small, white, borne in compound umbels 1 to 4 inches across; seeds are oval $\frac{1}{8}$ inch long, yellow with dark brown ribs.
Sorghum *Sorghum vulgare*	Cultivated plant.....	Late summer.....	Annual forage grass growing to a height of 5 feet; seed head an open panicle; seed in pairs—one fertile, one sterile.
Baneberry *Actaea rubra*	Woodlands and wooded ravines.	Mid-May onward..	Herb, 18 inches to 2 feet high with wide spreading compound leaves. The inflorescence is a compact cluster of small white flowers followed by stalked red or white oval or spherical berries, from $\frac{3}{8}$ to $\frac{1}{2}$ inch in diameter.
Poison Ivy *Rhus radicans*	Ravines, shaded places, stream banks.	Entire summer	Low, woody stemmed shrub; erect or climbing, with alternate compound leaves, each with three leaflets. The flowers are inconspicuous and greenish-white, followed by clusters of greenish-white to cream colored berries about $\frac{1}{4}$ inch in diameter.

Appendix II

PLANTS POISONOUS TO LIVESTOCK, SYMPTOMS OF POISONING, AND TREATMENTS

Name of Plant	Animal Affected	Poisonous Period	Symptoms	Treatment
Arrowgrass	Sheep and cattle	April to October	Increase in pulse and breathing rate; paralysis and convulsions.	Injection of sodium thiosulphate and sodium nitrite.
Death camas	Cattle and sheep	April to August	Slobbering, increase of breathing rate, and coma.	Keep animals quiet, see that they have food and water as needed, injection of death camas tablets.
Greasewood	Sheep and calves	April and May	Depression, weakness, weak pulse, and in some cases weak shallow breathing.	As a preventive measure, hungry animals should be fed hay or some other forage before they are allowed to consume large amounts of greasewood.
Dwarf and tall larkspur	Cattle	Entire life of plant	Inability to walk without stumbling, nausea, bloating, convulsions.	Rest and keep quiet.
Chokecherry	Lambs, cattle, sheep	Young leaves	Uneasiness, staggering, convulsions, breathing trouble, bloating.	Corn syrup drenches; add sulphur to salt 1:12.
Silvery lupine	Sheep, occasionally cattle and horses.	Seed pods most dangerous; leaves occasionally cause poisoning.	Nervousness, labored breathing, convulsions, frequent frothing at the mouth.	No treatment satisfactory; avoid pasturing heavy patches.
Milk vetches	Cattle, sheep	Entire life of plant	Skin eruptions, sterility in females	Change to non-seleniferous feed.
Locoweed	Horses, cattle, sheep	Any period of year	Loss of muscular control, loss of appetite, shaggy coat, nervous insensibility.	Horses—Fowler's solution, 20 c.c. daily in drinking water. Cattle—Strychnine hypodermically, 4/20 grain daily for about 30 days. Best practice is to remove animals from infested area at first signs of poisoning.
Western water hemlock	Cattle horses, sheep	May to October	Acute abdominal pains, excitement and convulsions.	No antidote is known.
Sorghum and flax	Cattle, sheep	After frost	Similar to those described for chokecherry.	As for chokecherry.
Baneberry	Children	Berries, June onwards	Increased pulse, dizziness, colicky stom-	Give an emetic and send for a doctor.

Baneberry	Children	Berries, June onwards	Increased pulse, dizziness, colicky stomach pains.	Give an emetic and send for a doctor.
Poison ivy	Humans and dogs	Any season, the resinous juice from any part of plant.	Rash blisters, severe irritations and swelling.	Application of potassium permanganate, 5 per cent solution, or calamine lotion. Wash in laundry soap and warm water.
Oat hay	Cattle, sheep, horses	Hay fed at any season	Dullness, gnawing wood, blood a dark brown color.	Intravenous injections of a 4 per cent solution of methylene blue in water—one ounce per 300 pounds liveweight.
Bloat	Cattle, sheep, goats	Fresh legume pasture	Excessive and rapid swelling of paunch.	Drench with 2 to 4 ounces of a mixture of turpentine, ginger, and capsicum; paunch with a trocar in extreme cases.

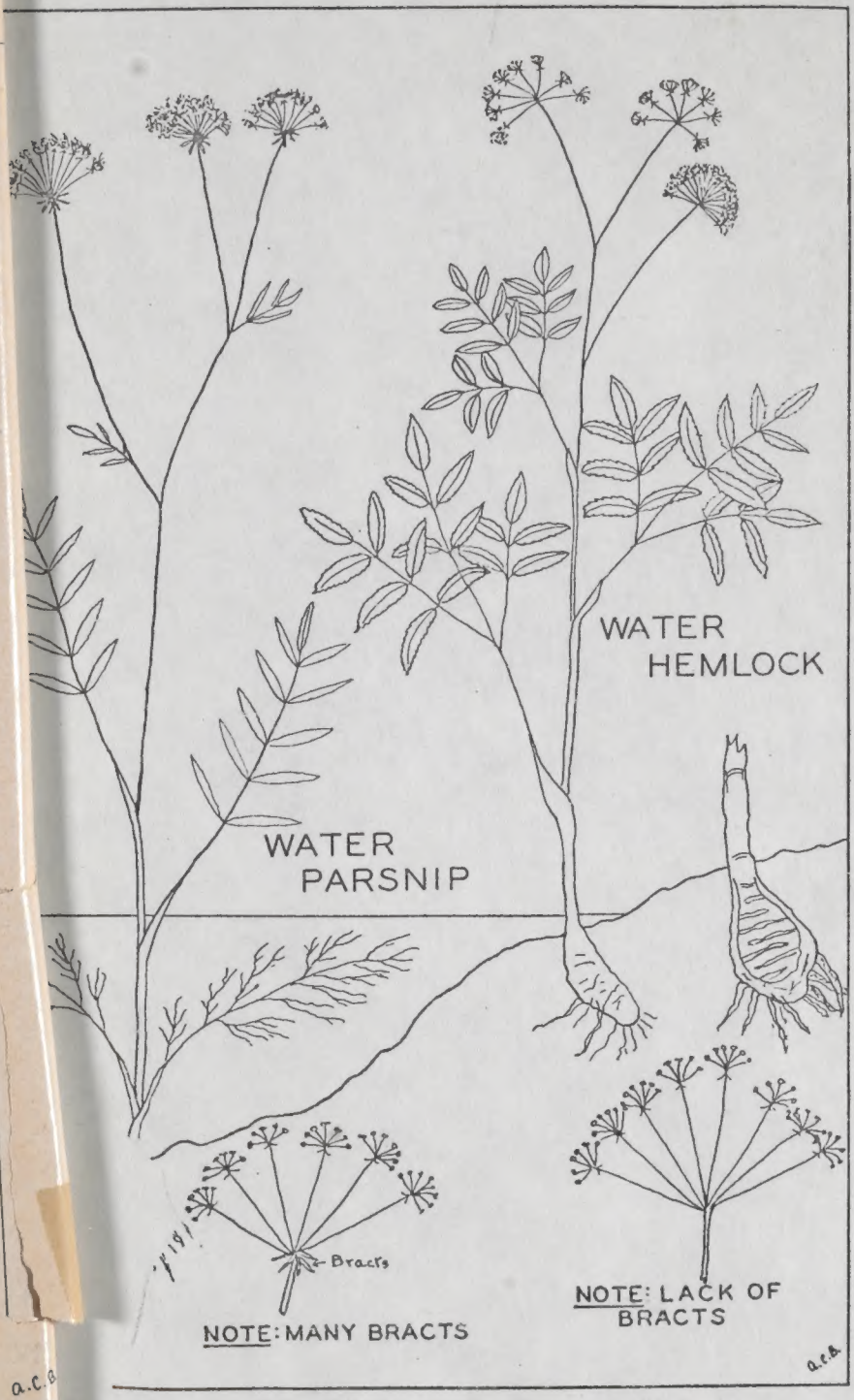

SEASIDE
ARROWGRASS
DEATH CAMAS
a.c.b.

LOW LARKSPUR
TALL LARKSPUR
A.C.B.

SMARTWEED
OR LADY'S THUMB
GREASEWOOD
A. C. B.

CHOKECHERRY
cross section of fruit
TWO-GROOVED MILK VETCH
GOLDEN BEAN.
A.C.B.

NARROW-LEAVED
MILK VETCH
EARLY YELLOW
LOCOWEED
LUPINE


WATER
HEMLOCK
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